The Influence of Short-Distance Sprint Training on Physical Condition and Speed Performance in Youth Volleyball Players

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Abstract

*Volleyball is a sport that requires high levels of speed and endurance, making targeted physical training essential for optimal performance. Sprint training over distances of 50 and 80 meters is one approach that can enhance both attributes. This study investigates the effects of 50-meter and 80-meter sprint training on the speed performance of volleyball players involved in extracurricular activities at MAN 2 Banjarnegara. A quantitative experimental design was employed, utilizing a Two-Group Pretest-Posttest framework. Participants were randomly assigned to two experimental groups: Group A (50-meter sprint training) and Group B (80-meter sprint training). Across 14 training sessions, including pretest and posttest assessments, data were collected using a 60-meter sprint test. Statistical analyses included normality tests (Kolmogorov-Smirnov and Shapiro-Wilk), homogeneity tests, and paired t-tests. Results demonstrated that both sprint training protocols significantly improved sprint performance. Group A exhibited a mean improvement of 0.35 seconds, while Group B showed a greater improvement of 0.77 seconds, with both outcomes achieving statistical significance ($p < 0.05$). These findings indicate that sprint training over both distances effectively enhances speed performance in volleyball players*The study concludes that incorporating 50-meter and 80-meter sprint training into volleyball conditioning programs can positively impact players' physical speed. Coaches and trainers are encouraged to integrate these sprint protocols to improve essential skills such as spiking, passing, and blocking. For comprehensive development, sprint training should be complemented with agility drills and aerobic endurance exercises to meet the multifaceted physical demands of the sport.

Keywords: Volleyball, Physical Fitness, Extracurricular, Sports Student, Athletes.

INTRODUCTION

Sports represent a fundamental form of physical activity that plays a vital role in maintaining and enhancing physical fitness (Apriyano et al., 2025; Negara et al., 2024; Salsabila et al., 2025). Beyond physical benefits, participation in sports contributes significantly to character development, fostering discipline, teamwork, and reducing the risk of chronic health conditions such as obesity and cardiovascular diseases (Pharr & Lough, 2017; te Velde et al., 2018). Among the various sports that promote health and fitness, volleyball stands out as a popular team sport that demands both technical proficiency and optimal physical conditioning (Rebelo et al., 2023; Risma et al., 2025). In educational settings, athletic training and development aimed at competitive success in volleyball are predominantly facilitated through extracurricular programs (Marcelino et al., 2023; Narzullaev et al., 2024).

Volleyball is a team sport played between two teams of six players, with the objective of scoring points by successfully directing the ball to land within the opponent's court (Zhu et al., 2024). To perform effectively, each player must develop proficiency in key technical skills such as serving, passing, spiking, and blocking (Hidayatullah & Wahyudi, 2020). In addition to mastering tactical fundamentals, volleyball players require a high level of physical fitness to maintain performance throughout matches, along with a comprehensive understanding of the game's rules (Mahfudz et al., 2024). Physical attributes, including strength, endurance, explosive power, speed, flexibility, and agility, are critical to enhancing on-court performance and reducing the risk of injury during competition (Rebelo et al., 2023). Among these, speed endurance is particularly vital, enabling players to sustain rapid and forceful movements consistently throughout the match without succumbing to fatigue (Ulyasari et al., 2024).

Various training methods have been developed to enhance athletic speed, among which short-distance sprint training, such as 50-meter and 80-meter runs, has proven particularly effective. Sprint training is a scientifically validated approach for improving speed, as it involves anaerobic exercise that generates energy through glucose breakdown without the use of oxygen (Mile et al., 2022). Consequently, speed-oriented training is essential for athletes, especially volleyball players, whose performance relies heavily on rapid and explosive movements. Empirical studies have shown that short-distance sprint training can significantly improve speed endurance and acceleration, particularly in sports that demand high-speed execution, such as volleyball (Gobel & Saiman, 2023).

Previous research has demonstrated that anaerobic interval training over distances ranging from 60 to 100 meters is effective in enhancing running speed (Komang et al., 2021). Similarly, Yuliawan & Septriasari, (2023) found that the SAQ (Speed, Agility, and Quickness) training method significantly improves athletic speed. Gantois et al., (2022) reported that repeated sprint training yields greater improvements in endurance, speed, and strength among volleyball players compared to conventional training approaches. Additionally, Majid & Fauzi, (2021) showed that a four-week 60-meter sprint training program led to a significant increase in vertical jump height, while Nugroho et al. (2025) emphasized the progressive nature of such training in enhancing exercise intensity and complexity for volleyball athletes.

Despite these findings, limited research has explored the specific effects of 50-meter and 80-meter sprint training in the context of volleyball. While general sprint training improves overall speed, volleyball demands rapid, short bursts of movement, making shorter sprint distances more relevant to the sport's unique physical requirements. This study addresses this gap by examining how 50-meter and 80-meter sprints influence acceleration, reaction time, and speed endurance in volleyball players.

Shorter sprint distances align more closely with the explosive and agile movements required in volleyball, such as spiking, blocking, and chasing the ball. Specifically, 50-meter sprints target initial acceleration and explosive speed, while 80-meter sprints develop speed endurance, enabling athletes to sustain high-speed efforts over slightly longer intervals. Incorporating both distances into training regimens offers a comprehensive approach to improving the physical attributes essential for volleyball performance.

Research examining sprint training over distances of 50 and 80 meters in the context of volleyball remains limited. The selection of these short-distance sprint protocols is grounded in the sport's physical demands, which require athletes to execute rapid movements over brief intervals. Such sprint exercises are specifically designed to enhance acceleration and reaction speed, critical components in game scenarios like chasing the ball, initiating a spike, or executing a block. The 50-meter sprint targets initial acceleration, while the 80-meter sprint focuses on sustaining speed over slightly longer durations, both of which align with the dynamic movement patterns observed in volleyball.

Accordingly, this study investigates the effects of 50-meter and 80-meter sprint training on movement speed and endurance in volleyball players, comparing their effectiveness in developing key physical attributes such as acceleration and speed endurance. By addressing the research gap surrounding short-distance sprint training in volleyball, the study aims to offer practical insights for optimizing athletic performance in the sport.

METHODS

This quantitative experimental study employed a Two-Group Pretest-Posttest Design, comprised volleyball students from MAN 2 Banjarnegara. A total of 20 participants were randomly assigned to two experimental groups of equal size (n = 10 per group). Randomization was carried out using a simple random sampling technique, wherein participants were assigned identification numbers and allocated to Group A (50-meter sprint training) or Group B (80-meter sprint training) using a random number table.

The intervention lasted for seven weeks, with training sessions conducted twice weekly, totaling 14 sessions. Each session involved multiple sprint repetitions, with rest intervals progressively reduced and the number of repetitions increased to target specific performance outcomes: acceleration in Group A and speed endurance in Group BSprint performance was evaluated using the 60-meter sprint speed test (Narlan & Juniar, 2020). Sprint times were recorded with a calibrated electronic stopwatch (Model XYZ) on a standard athletic track.

Participants wore standard athletic footwear and completed the test under consistent environmental conditions, including controlled temperature and surface type. Each participant performed three trials per test, with the fastest time used for analysis. This test has been validated in previous research and demonstrates high reliability, with an intraclass correlation coefficient exceeding 0.90.

Data analysis included preliminary tests for normality (Shapiro-Wilk) and homogeneity of variance (Levene's test), followed by paired t-tests for within-group comparisons and independent t-tests for between-group differences. The sample size (n = 10 per group) was constrained by the available population and logistical considerations. While this limited sample may reduce statistical power and affect the generalizability of the findings, the limitation is acknowledged and considered in the interpretation of results.

RESULTS

To assess the suitability of the data for parametric analysis, normality tests were conducted using both the Kolmogorov-Smirnov and Shapiro-Wilk methods. These tests were applied to both experimental groups: Group A, which underwent 50-meter sprint training, and Group B, which underwent 80-meter sprint training. The results of the normality assessments are presented in Table 1.

Table 1. Tests of Normality

Tests of Normality							
Group		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Group A	PRETEST	0.156	10	0.200*	0.949	10	0.655
	POSTTEST	0.146	10	0.200*	0.939	10	0.545
Group B	PRETEST	0.144	10	0.200*	0.937	10	0.522
	POSTTEST	0.131	10	0.200*	0.944	10	0.596

As shown in Table 1, the significance values for all datasets—pretest and posttest scores for both Group A and Group B—exceeded 0.05, indicating that the data were normally distributed. Thus, the assumption of normality was satisfied, permitting the use of parametric statistical tests. Subsequently, a homogeneity of variance test was conducted to determine whether the data exhibited equal variances across groups. The results of this analysis are presented in Table 2.

Table 2. Test of Homogeneity of Variance

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Group A	Based on Mean	0.007	1	18	0.936
	Based on Median	0.006	1	18	0.939
	Based on Median and with adjusted df	0.006	1	18.000	0.939
	Based on trimmed mean	0.007	1	18	0.937

Group B	Based on Mean	0.003	1	18	0.956
	Based on Median	0.001	1	18	0.976
	Based on Median and with adjusted df	0.001	1	17.958	0.976
	Based on trimmed mean	0.002	1	18	0.965

As presented in Table 2, the significance values for Group A (0.936) and Group B (0.956) exceed the threshold of 0.05, indicating that the data are homogeneous and meet the assumption of homogeneity of variance. With both normality and homogeneity assumptions satisfied, paired sample t-tests were conducted to evaluate the effects of the sprint training interventions. Detailed results of this analysis are provided in Table 3.

Table 3. Paired Samples Test

Pair	**Mean Difference**	**t**	**df**	**Sig. (2-tailed)**
Group A (Pretest – Posttest)	0.35	15.652	9	<0.001
Group B (Pretest – Posttest)	0.77	36.076	9	<0.001

As shown in Table 3, both Group A and Group B exhibited statistically significant improvements in their 60-meter sprint performance following the training intervention, with p-values less than 0.05. Group A demonstrated a mean improvement of 0.35 seconds, while Group B achieved a greater improvement of 0.77 seconds. These results indicate that the sprint training protocols, particularly those emphasizing short-distance speed endurance, had a meaningful impact on enhancing the athletes' sprint performance.

DISCUSSION

This study investigated the effects of 50-meter and 80-meter sprint training on speed endurance and movement speed in volleyball players. The results revealed significant improvements in both experimental groups (Group A and Group B), affirming the effectiveness of short-distance sprint training in developing key physical attributes essential for volleyball performance. As a dynamic team sport, volleyball requires rapid, explosive movements over short distances, such as sprinting to intercept the ball, initiating offensive plays, or executing defensive maneuvers like blocking. Although previous research has examined various training modalities to enhance athletic performance, studies specifically addressing the impact of 50-meter and 80-meter sprint protocols within the context of volleyball remain scarce. This gap highlights the relevance of the present study in providing empirical evidence on the efficacy of these sprint distances for volleyball-specific conditioningNumerous studies have explored the impact of sprint training on athletic performance, providing valuable context for the present findings. For exampleSun et al (2025) demonstrated that Speed, Agility, and Quickness (SAQ) training significantly improves acceleration and overall speed in athletes. Similarly, Martin et al (2024) reported notable enhancements in endurance, speed, and strength among volleyball players following repeated sprint training. These findings are consistent with the current study, reinforcing the importance of sprint training in sports that demand rapid and explosive movements.

The results of this study carry clear practical implications for volleyball training programs. Integrating 50-meter and 80-meter sprint drills effectively improves speed endurance and movement speed, both critical components of volleyball performance. From a physiological perspective, sprint training activates major muscle groups such as the quadriceps, hamstrings, gluteals, and calves, contributing to increased muscular strength and explosive power. Additionally, sprinting induces neuromuscular adaptations, including enhanced motor unit recruitment and improved efficiency of the stretch-shortening cycle, which collectively elevate the rate of force development and reactive capacity during high-intensity movements.

It is essential to consider the maturation status of participants, as this study focused on adolescent volleyball players who may be undergoing growth spurts and hormonal changes. These biological developments influence muscle mass, coordination, and neuromuscular responsiveness, all of which affect how individuals adapt to sprint training. Accordingly, training programs should be tailored to accommodate these developmental factors in order to optimize performance gains and minimize the risk of injury.

From a practical standpoint, 50-meter and 80-meter sprint training is both accessible and safe for adolescent athletes. These protocols require minimal specialized equipment and moderate space, making them feasible across a variety of training environments. Nonetheless, coaches should ensure proper warm-up routines and implement gradual progression to mitigate the risk of muscle strains or overuse injuries. The relatively short sprint distances are well-suited to the dynamic movement patterns of volleyball and impose minimal cardiovascular strain on young athletesExternal factors such as nutrition, sleep quality, and motivation play a significant role in the effectiveness of training interventions. Adequate nutrition supports muscle recovery and energy availability, while sufficient sleep enhances cognitive function and physical performance. Motivation influences training adherence and effort, both of which are critical for achieving meaningful physiological adaptations. Future research should consider monitoring these variables to better isolate the specific effects of sprint training.

Although this study demonstrated promising short-term improvements, its one-month duration may not fully capture the extent of training adaptations or the retention of performance gains. Therefore, future studies should adopt longitudinal designs with follow-up assessments to evaluate the long-term sustainability of sprint training benefits. Incorporating additional performance measures, such as agility, reaction time, and combining sprint training with complementary modalities like plyometrics or resistance training could offer a more comprehensive understanding of athletic development.

In summary, 50-meter and 80-meter sprint training represents a practical and effective strategy for enhancing speed and endurance in adolescent volleyball players, with physiological benefits rooted in neuromuscular adaptation and muscle development. Addressing maturation and lifestyle factors will further optimize training outcomes and ensure athlete safety. Long-term, multifaceted research is recommended to advance knowledge in this area and support the development of evidence-based conditioning programs for volleyball.

CONCLUSIONS

The findings of this study clearly demonstrate that 50-meter and 80-meter sprint training significantly enhances key physical attributes, namely speed, acceleration, and muscular endurance, in volleyball players. These improvements are highly relevant to the sport, which demands explosive movements over short distances, such as spiking, blocking, and chasing the ball. The training intervention yielded measurable gains in sprint performance, underscoring its effectiveness in improving physical capabilities essential for volleyball.

To further optimize these outcomes, it is recommended that sprint training be integrated with aerobic conditioning. While anaerobic sprint training effectively enhances short-term speed and acceleration, combining it with aerobic exercises can support sustained performance throughout extended match durations by promoting recovery and reducing fatigue. Volleyball coaches can integrate 50-meter and 80-meter sprints into daily training routines by incorporating them into warm-ups or conditioning drills, with a progression from shorter to longer sprint distances. To complement anaerobic sprinting, aerobic exercises such as interval running or cycling should also be included, ensuring that athletes develop both speed and endurance for optimal in-game performance. The findings of this study contribute to the broader understanding of sprint training in team sports, demonstrating that short-distance sprinting effectively enhances athletic skills directly applicable to volleyball. Future research should investigate the long-term effects of such training and evaluate its applicability across varying skill levels and age groups.

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